

Scientific retreats with 'speed dating': networking to stimulate new interdisciplinary translational research collaborations and team science

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ABSTRACT

To stimulate the formation of new interdisciplinary translational research teams and innovative pilot projects, the South Carolina Clinical and Translational Research (SCTR) Institute (South Carolina Clinical and Translational Science Award, CTSA) initiated biannual scientific retreats with 'speed dating' networking sessions. Retreat themes were prioritized based on the following criteria; cross-cutting topic, unmet medical need, generation of novel technologies and methodologies. Each retreat begins with an external keynote speaker followed by a series of brief research presentations by local researchers focused on the retreat theme, articulating potential areas for new collaborations. After each session of presentations, there is a 30 min scientific 'speed dating' period during which the presenters meet with interested attendees to exchange ideas and discuss collaborations. Retreat attendees are eligible to compete for pilot project funds on the topic of the retreat theme. The 10 retreats held have had a total of 1004 participants, resulted in 61 pilot projects with new interdisciplinary teams, and 14 funded projects. The retreat format has been a successful mechanism to stimulate novel interdisciplinary research teams and innovative translational research projects. Future retreats will continue to target topics of cross-cutting importance to biomedical and public health research.

INTRODUCTION

The 2004 National Academies Report entitled 'Facilitating Interdisciplinary Research' defined 'interdisciplinary research' as a mode of research in which individuals from two or more disciplines to work together to advance understanding or solve problems whose solutions are beyond the scope of a single discipline.¹ Interdisciplinary collaboration involves integrating each team member's unique expertise to address a research problem effectively to advance knowledge.² There is growing recognition and national focus within the leading research institutions such as National Science Foundation (NSF), National Institutes of Health (NIH), Clinical and Translational

Significance of this study

What is already known about this subject?

- ▶ The value and need to promote team science to advance translational research.
- ▶ The knowledge of certain barriers such as geographic distance between researchers, siloed environments, lack of a common forum to meet and share research ideas and opportunities to network and stimulate formation of interdisciplinary collaborations.
- ▶ Lack of innovative approaches to promote team science.

What are the new findings?

- ▶ The format of the scientific retreat has proven to be an effective approach to foster new interdisciplinary research team formation and innovative research ideas.
- ▶ The format provides opportunities for 'speed dating' style networking and pilot project funding to help catalyze a collaborative environment to generate new research ideas to advance team science and translational research.
- ▶ The retreats include a mechanism for funding research that fosters opportunities for stakeholders of disparate disciplines to have an impact in an area of unmet medical needs.

How might these results change the focus of research or clinical practice?

- ▶ This format of scientific retreats helps to advance translational research by providing a venue to catalyze team science among stakeholders with widely different expertise that otherwise would not happen.

Science Awards (CTSA) Program as well as academic institutions of the need to support infrastructure that will foster interdisciplinary collaborative team work. An Institute of Medicine report in 2014 emphasized the need



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and importance of team-based collaborations across disciplines to overcome barriers within academic cultures.³ Innovative strategies are needed to facilitate interdisciplinary research by promoting awareness of research across disciplines, sharing ideas and methodologies.⁴ The value of developing interdisciplinary collaborations and understanding how to foster them within translational research teams has shown positive outcomes in terms of training, higher innovation defined as publications in different areas of science, grant applications, patents and citations.^{5–11} These positive outcomes are the result of sharing ideas, expertise and tools from different disciplines. The benefits of working across disciplines and organizational boundaries may be difficult to achieve due to barriers such as geographic distance between researchers, lack of a common forum to meet and share research ideas, costs involved and lack of appropriate rewards for team science within academic cultures.^{11–13} Even though communication technologies to connect geographically distant people to form ‘virtual teams’ have been advanced, effective coordination has proven challenging. Consequently, fewer positive outcomes among projects with investigators from more universities have been observed than in projects with fewer universities.^{6, 14} The importance of having space and opportunities for researchers to meet each other freely and develop novel collaborations have shown positive outcomes in terms of relationships and group dynamics, increasing members participation in handling difficult issues and identifying next steps for success.¹⁵ Therefore, innovative approaches, beyond science, are needed to increase the face-to-face interactions that will stimulate interdisciplinary and interorganizational collaborations. However, information is lacking on ‘best-practices’ in facilitating the formation of new interdisciplinary research teams. Few studies have shown that the conferences bringing distant researchers together can reduce the difficulties inherent in collaborations involving multiple universities and increase long-term collaborations.⁵ In one study, randomly assigning potential collaborators to a 90 min structured information-sharing session in a break-out room increased the likelihood of collaborations among those in the same specialization when compared with those who were assigned to different break-out rooms.¹⁶

The intervention that we tested focused on scientific retreats based on the principle that these forums offer a positive and collaborative environment that promotes exchange of research ideas and novel approaches to solve research problems. Retreats alone do not address the roadblock of lack of resources to develop new research teams, so we coupled the retreats with access to retreat-themed pilot project funding. Further, a retreat comprised solely of scientific presentations does not necessarily foster the social interactions needed to develop new research teams, so we integrated the notion of ‘scientific speed dating’ into the retreat format. We tested that by bringing basic scientists, clinicians, clinician-scientists, population scientists, state regulatory agencies and community stakeholders (figure 1) together in a forum to share research ideas via a scientific retreat with networking opportunities and funding for pilot projects would stimulate the formation of interdisciplinary research teams. The overall goals of the retreats were to facilitate collaborations between researchers and other

stakeholders in the state of South Carolina and to form successful interdisciplinary and collaborative research teams to address major unmet medical needs.

METHODS

Retreat logistics

The scientific retreats last ~8 hours and are held semi-annually, Spring and Fall, with a continental breakfast and lunch provided. The investigators and/or community stakeholders propose retreat themes to SCTR Institute leadership who review suggested topics for appropriateness, timeliness and scope. Retreat theme selection is determined by the following factors: cross-cutting topics, unmet medical needs, complexity requiring interdisciplinary team collaborations and/or the facilitation of novel methodologies and technologies. After a theme is selected, experts who are faculty members in different disciplines but actively involved in research in the area of the retreat theme are asked to participate in a retreat planning committee. The committee membership and number varies depending on the retreat. The committee selects keynote speakers, local platform and/or poster presentations and plans networking sessions. A ‘Save the Date’ notification soliciting registration and abstracts submission is sent via list serves to investigators, clinicians, healthcare partners and community stakeholders throughout the state of South Carolina. Announcements are sent out via the SCTR Institute e-list, university wide e-lists, newsletters including a community newsletter and broadcast messages to cover broader constituencies. Keynote speakers are nationally recognized experts in the retreat thematic area who are actively involved in translational research. The keynote address serves to open and provide a context for the day. Other presenters are selected based on submitted abstracts which are judged on importance to the retreat theme, scientific quality, interdisciplinary collaborations and translational research potential. The abstracts are graded, summarized and presented to the committee for review and discussions to make decisions and develop the retreat agenda. The agenda is finalized with attention being paid to include presenters from different disciplines. The platform presenters are instructed to have slides in which they would include key research data, results and conclusions with the last 1–2 slides indicating potential areas for collaborations and expertise needed to advance the research. In order to have the attendees participate throughout the retreat, the agenda is developed to have a mixture of different talks throughout the day and ending with a presentation of the SCTR Pilot Project Program funding opportunities and Request for Applications (RFA) information. Several weeks before the retreat, the agenda, presentation abstracts and registered attendees contact information are sent to all the registrants to facilitate potential networking contacts before the retreat.

Attendees evaluated the retreat using a one page (both sides) paper and pencil evaluation survey form (figure 2) which was built using the REDCap survey. The evaluation form was built as a simple one pager hoping to receive most of the attendees feedback. The form was included in each attendee’s folder given to them at the registration desk. The attendees were informed at the beginning of the retreat that the retreat evaluation form was in their folders

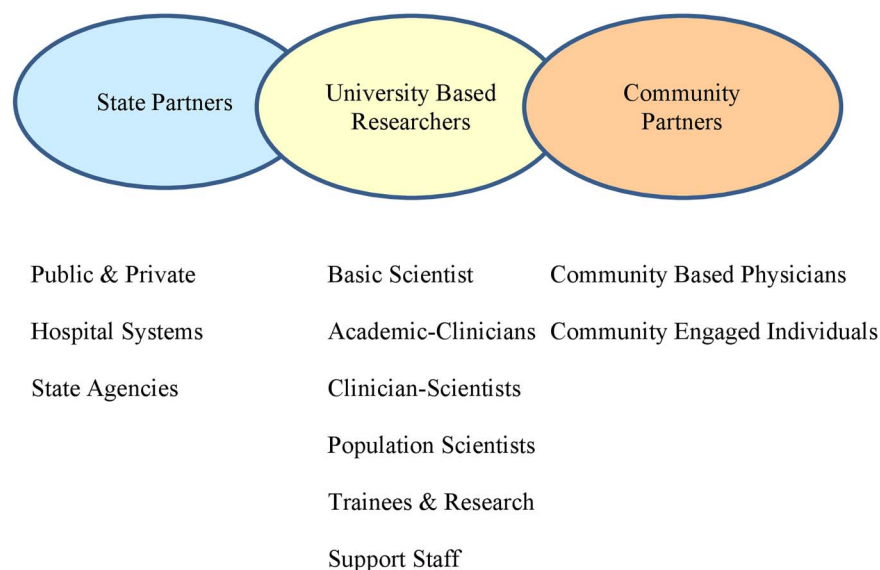


Figure 1 Representation of the scientific retreat attendees.

and importance of filling it out and returning it back before they leave the retreat. They were reminded several times during the retreat. After the retreat was over, the evaluation form as an electronic REDCap survey link was sent to all the attendees via emails. This was performed in an attempt to capture more evaluations since some attendees left the retreat before it was over and some had not returned the evaluation forms. They were asked to provide the feedback to the electronic survey within a week. The evaluation form consisted of three main questions and a demographic section. The three questions were: How well did the retreat help you achieve the goals of the retreat, How would you rate these aspects of the program and Retreat satisfaction. Under each of these three questions, four to five subquestions were included to gather attendees feedback in four broad areas-innovation, content, logistics and overall satisfaction. Most of the subquestions were single choice questions with check boxes to indicate the answers in a scale of Poor, Fair, Good and Excellent except the three open-ended qualitative questions under the satisfaction criteria where the attendees feedback was to provide suggestions for retreat improvements and to indicate the new collaborators and/or novel ideas the attendees were able to develop as a result of the retreat. The innovation criterion was assessed using the attendees responses to the questions whether they were able to meet new collaborators and identify new research areas/projects. The content criterion was assessed using the attendees responses to the breadth of topics covered, whether the topics are timely and new information provided (ie, met attendees expectations) and speaker quality. The logistics-related criterion was assessed using the attendees responses to the time of the day and length of the retreat to capture information that would be useful for organizing the future retreats. The satisfaction criterion was assessed using the attendees responses to the satisfaction with retreat/would recommend the retreat to others. The evaluation forms content that was used for all the retreats to assess the four main criteria listed above were similar. The evaluation form

data were entered to the REDCap to generate Excel spread sheets to manage and analyze the data. Although in initial retreats, there was no attendees demographic data questions were included in the evaluation form, they were included in the evaluation form that was used in the last three retreats (figure 2) to subsequently collect those data. However, attendees were not required to provide the demographic data and no personal identification questions were included in the evaluation form. Therefore, the evaluation form was not required for Institutional Review Board approval.

Retreat format

The retreats (table 1) start with a keynote address by a nationally renowned individual addressing the key thematic issues followed by three to four sessions of research presentations. Each research presentation session includes four 10 min research presentations with 5 min for Q & A highlighting future research that may require new interdisciplinary collaborations. 'Speed dating' sessions, lasting for 20–30 min, are held in between each of the research presentation sessions. During these sessions, research presenters and attendees interact to make contact and share ideas related to specific questions and research collaboration ideas. Following the research presentations, a panel composed of session moderators and keynote speakers summarizes key points of the retreat, pointing out opportunities for collaboration. The retreats conclude with an overview presentation of the SCTR Institute Pilot Project Program RFA and how to apply for research funding. The attendees are also informed of the other free research support services and consultations services offered by the SCTR Institute. After the retreat, a summary of the retreat, slides and recordings, evaluation form and the RFA are sent to the attendees. Pilot project funding is set aside solely for retreat attendees to support new, innovative interdisciplinary pilot projects that emanate from the retreats.

Different ways have been tried to optimize the speed dating style networking in the retreats. In all the retreats,

Tobacco Related Research Retreat Evaluation Form

We would like to hear your feedback for the Tobacco Retreat today. Please fill in this confidential evaluation form and give to us/drop into the 'evaluation basket' in the Lobby SCTR Table before you leave today.

Thank you for your help.

How well did the retreat help you achieve the following goals:

	1 Poor	2 Fair	3 Good	4 Excellent
Meet new collaborators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Identify new research areas/projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Presentation of new idea or novel approach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research career development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How would you rate these aspects of the program:

	1 Poor	2 Fair	3 Good	4 Excellent
Breadth of topic coverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Timely/new information provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speaker quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time of the day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Length of the retreat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Satisfaction

	1 Poor	2 Fair	3 Good	4 Excellent
Satisfaction with retreat (would recommend to others)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you rated any of the items above as fair or poor, or if you have other suggestions for improvement, please explain:

Please list the last name/s of any presenters and/or conference attendees who presented you with a new idea and/or potential topic (include the idea/topic using few key words) that you would like to collaborate towards a new project:

A primary goal of the retreat is to provide opportunities to meet new collaborators across disciplines. How can we improve this aspect of the retreat?

Institution:

- ☐ Clemson
☐ MUSC
☐ USC
☐ DHEC
☐ Other Institution
☐ Other - Community

If Other, please specify:

Figure 2 Evaluation form used in the Tobacco Control retreat.

the attendees information, including their specific research field/s and retreat agenda, were sent out to all the registered attendees, at least a week before, asking the attendees to make connections with the other attendees even before they attend the retreat. A continental breakfast, two coffee breaks (morning and afternoon) and working lunch set around round tables were included on the day of the retreat to stimulate networking. In some retreats, we included specific round table topics such as 'clinical round table' to stimulate networking on problems needing basic

science solutions (Bioengineering retreat); working lunch with a 'semiextemporaneous debate' (Telemedicine retreat); 'working lunch with questions' (Neurological Diseases and Injury retreat); 'breakout sessions with experts'—allowing attendees to opt out for a session of their choice (mHealth Technology retreat); 'poster presentations combined with networking' at lunch (Implementation Science, Obesity, Pain and Tobacco Control retreats); morning assigned breakout sessions with an icebreaker exercise and then themed breakout roundtable sessions where the topics for

Your Primary Role at the Conference:

- ☐ Administration
- ☐ Faculty
- ☐ Research Staff
- ☐ Student/Trainee
- ☐ Advocate
- ☐ Other

If Other, please specify:

Please include your primary area of research:

- ☐ Basic Science
- ☐ Clinical Science
- ☐ Health Services
- ☐ Community Engagement
- ☐ Translational Science
- ☐ Other
- ☐ Not applicable

If Other, please specify:

Are your research population includes:

- ☐ Prenatal (Conception to birth)
- ☐ Infancy (Birth to ~ 18 months)
- ☐ Early Childhood (~ 18 months to ~ 6 years)
- ☐ Late Childhood (~ 6 years to ~ 13 years)
- ☐ Adolescence (~ 13 years to ~ 20 years)
- ☐ Early Adulthood (~ 20 years to ~ 30 years)
- ☐ Middle Adulthood (~ 30 years to ~ 65 years)
- ☐ Late Adulthood (~ 65 years and older)

Special Populations (as research subjects):

- ☐ Women
- ☐ Minority racial/ethnic populations
- ☐ Low income
- ☐ Low educational attainment
- ☐ Disability
- ☐ LGBTIQ sexual Orientation
- ☐ Rural/Inner city residents

Figure 2 Continued

discussions were selected based on the attendees suggested topics earlier on the day (Implementation Science retreat); working lunch networking session targeted on grant development and a Q/A session (Patient-Centered Outcomes Research Retreat); and wine and cheese networking reception at the end of the retreat day (Tobacco Control retreat). With the evolution of the retreats, we have found that speed dating after three to four 15 min presentations seems to work the best. In order to catalyze the speed dating sessions, the keynote speaker and local talk presenters were asked to include a slide or two at the end of their talks with information such as research ideas and/or issues that need new interdisciplinary team collaborations to advance the field.

A pilot project funding opportunities flyer was included in the attendees folders. The availability of funding was announced at the beginning of the retreat, but detailed information about the Request for Applications (RFA), including how to apply for a pilot project grant, was provided during the 'Funding Opportunities' presentation at the end of the retreat (table 1). This was performed purposely to encourage the attendees to stay throughout the retreat. Once the retreat was over, the funding information was sent out to all the attendees via an email. Depending on the RFA, there were three to five grant categories announced with different dollar amounts. The grant categories and dollar amounts for a 12-month pilot project were: Discovery grants for \$25,000–50,000, Community-University Partnership grants for \$20,000, Community Engaged Scholars for \$10,000, Health Disparities for \$10,000 and High Innovation-High Rewards for \$10,000. Discovery grants are to facilitate any new and high impact pilot project idea within the translational spectrum from basic research to clinical research to community/

population-based research and vice versa. Community-University Partnership grants and Community Engaged Scholars grants are to facilitate any new community-related pilot project that address a health-related issue of a community with a significant involvement with at least one community entity/member from that community. Health Disparities grants are to facilitate any new pilot project that would address critical questions related to health disparities within the translational spectrum. High Innovation-High Rewards grants are to facilitate any new pilot project that may lead to substantial development of intellectual property rights and/or significant commercial opportunity for high reward. Since there were not reasonable number of applications received under the grant categories of Community-University Partnership and Health Disparities, they were combined into the Discovery grant category in the later years. In order to encourage new translational research team formation and generation of novel research ideas as a result of the retreats, we requested that at least one of the team members should have attended the retreat and the proposed project idea should be novel and interdisciplinary in nature to qualify for the pilot project funding that was set aside for the retreat generated pilot projects. The principal investigator (PI) or co-PI of the pilot project applications are the faculty members at any level such as professor, associate professor, assistant professor and instructors. Other attendees and attendees who may not have academic faculty affiliations such as community members can be a part of the team as Co-investigators. The pilot project applicants are asked to indicate in their pilot project applications (in the project title and proposal) whether their proposed pilot project are a result of the retreat(s). The grant applications were reviewed by the SCTR Institute Scientific Review Committee. The pilot

Table 1 Typical agenda of the scientific retreat

8:30 AM	Registration and continental breakfast
9:00	Welcome and introduction
9:10	Morning keynote
10:10	Coffee break and networking ('Speed dating')
10:30	Session 1 (four short presentations, each with a 10 min talk followed by a 5 min Q & A session, moderated by an expert related to the retreat theme)
11:30	Working lunch and networking (round tables are set up to facilitate 'Speed dating' style networking)
12:30	Afternoon keynote
13:30	Session 2 (four short presentations, each with a 10 min talk followed by a 5 min Q & A session, moderated by an expert related to the retreat theme)
14:30	Coffee break/networking ('Speed dating')
15:00	Funding opportunities: SCTR Institute Pilot Project Program
15:15-16:00	Discussion, summary and future directions

project funding covers the expenses needed to successfully conduct the proposed project, including the efforts of the investigators, as appropriate, or as similar to the NIH salary cap at that time. When there are non-academic members such as community members involved in the project teams as investigators, their efforts are covered as an honorarium or consult costs, as appropriate, according to the university, state and federal guidelines. Applicants proposed budgets are reviewed by the SCTR Institute Finance Office and the applicants are guided to revise the budgets if necessary. There are no specific regulations imposed for the budgets except that the funding is not supported the Facilities and Administrative costs of the awards.

RESULTS

The SCTR Institute held a total of 10 retreats between 2009 and 2014. Retreat themes and number of attendees are listed in [table 2](#). Retreats had a South Carolina state-wide reach with an average of 100 attendees per retreat including participation from the other two research universities in the state (University of South Carolina and Clemson University), health and community stakeholders representing a multidisciplinary mixture of basic scientists,

academic clinicians, clinician-scientists, population scientists and community engaged individuals ([figure 1](#)). The total number of attendees for the 10 retreats was 1004. However, as some individuals attended more than one retreat, this number does not represent unique attendees. For example, we looked into the attendees information in 5 retreats where there were more than 100 attendees per retreat such as the mHealth Technology, Obesity, Patient-Centered Outcomes Research and Tobacco Control retreats ([table 2](#)). It shows that about 8% of the attendees were repeated attendees who attended more than one of the five retreats. Some of the retreat themes such as the Bioengineering and Regenerative Medicine, Obesity and Tobacco Control were either suggested and/or co-sponsored with the community stakeholders. For example, the idea for the obesity retreat initially came from the SCTR Community Advisory Board and Boeing, which has a major presence in Charleston, South Carolina, USA. Boeing provided partial support for the retreat and pilot project funding to implement collaborative projects involving partnerships between researchers and community organizations.

The average percentage of evaluation forms returned by the retreat attendees was 35%, with a range of 22–51% ([table 2](#)). The number of evaluation forms returned was lower than expected although we cannot pinpoint a specific reason as to why the numbers were low. Some attendees left the retreat before it was over and at different times throughout the day. It has been hard to follow them to gather the forms. Even after sending the form electronically to everyone who attended the retreat after the retreat was over, we received only 1–2 responses. We have not collected demographic data of the attendees in all the retreats. Where it was collected, the data show that the number of attendees in academia was higher than the rest of the state and community partners ([figure 1](#)). Hence, there was a tendency that the attendees in the academia have returned more forms than the rest. For example, the Tobacco Control retreat had a total number of 175 attendees in which there were about 150 in academia, 37 as state partners and 11 as community partners. Among the 175 attended, we received only 51 evaluation forms (29% of the total attendees as listed in the [table 2](#)) in which 29

Table 2 Scientific retreat themes and outcomes from 2009 to 2014

Retreat theme related to	Number of attendees	Number of evaluation forms returned (as a % of total attendees)	Number of new pilot project applications received (number funded)
Bioengineering and regenerative medicine	65	31 (48)	11 (1)
Telemedicine	70	36 (51)	8 (3)
Neurological diseases and injury	75	24 (32)	13 (1)
Biomedical imaging	65	28 (43)	10 (3)
mHealth technology	119	25 (21)	4 (2)
Obesity	130	59 (45)	8 (3)
Implementation science	115	30 (26)	2 (0)
Patient-centered outcomes research and comparative effectiveness research	130	45 (35)	1 (0)
Pain	60	22 (37)	2 (0)
Tobacco control	175	51 (29)	2 (1)
Total: 10 retreats	1004	351 (35)	61 (14)

were in academia, 15 state partners and 5 community partners (rest of the 2 forms had no responses to indicate who they were). We are working to implement a raffle with gift items to encourage a higher percentage of returns of the evaluation forms in the future retreats. For all retreats, attendees rated the retreats as 'good' to 'excellent' for about 90% or more. Satisfaction rate for the 'innovation' criteria listed in the retreat evaluation form was >80%. For the 'content' criteria, the satisfaction rate was >94%. For retreat 'logistics' criteria, the satisfaction rate was >78%. In terms of the retreat length, the attendees suggested having fewer research presentation sessions (about two sessions). However, overall, attendees liked the retreat format with short, 10 min research presentations with 5 min for Q & A, and 30 min of networking sessions. Attendees commented frequently that the retreats provided a unique opportunity to gather and exchange research ideas freely with other translational researchers and stakeholders throughout the state. The attendees participated in the speed dating style networking to various degrees. In some cases, some attendees networked with a specific presenter while some gathered around the round tables where there were six to eight people. Post-retreat communication with the SCTR Pilot Project Program staff indicate that the retreats facilitated the formation of new interdisciplinary research teams. A few quotes from those communications are exemplars of attendees experiences: 'The project overall has grown and would not be where it is now without SCTR Institute's retreats and early help with the pilot funding support'. In some cases, retreats have further enhanced ongoing collaborations and/or the translational research by 'watering it and helping it grow'.

We assessed the pilot project applications received by the SCTR Institute Pilot Project Program as a measure of interdisciplinary collaborations emanating from the retreats. The Pilot Project Program received 61 new research applications attributable to the 10 retreats (table 2). The applications were peer-reviewed for scientific merit by the SCTR Institute Scientific Review Committee. Based on the scientific merit, 14 applications with new interdisciplinary team collaborations resulting from the retreats have been funded. These 14 individuals are unique PIs and each of the applications funded are unique applications with novel research and interdisciplinary teams. As mentioned in the Methods section, at least one member of the team and/or all the PIs attended the respective retreat as listed in table 2. In some cases, retreats and pilot projects led to successful extramural grant applications. As per attendees responses to the postretreat follow-up surveys, there were seven extramural grant awards to seven unique PIs resulted from five retreats, Bioengineering, Telemedicine, mHealth Technology, Neurological Diseases and Obesity retreats. These seven PIs attended at least one of the five retreats. The Bioengineering and Obesity Retreats stimulated multidisciplinary investigators from two institutions (bioengineer from the Clemson University's Human Factors & Ergonomics Research Institute and a clinician from the Medical University of South Carolina Weight Management Center) to collaborate on two proposals to investigate a new device for weight loss which resulted in a Small Business Technology Transfer grant and an R01 grant. The Telemedicine Retreat facilitated the submission of three

successful proposals to receive two Duke Endowment grants (The Virtual TeleConsult Clinic and Remote Expert Assessment of Lung Cancer) and one Department of Defense grant (Southern Virtual Institute for Education and Wellness). The Neurological Diseases and Injury Retreat facilitated two successful applications, an NIH Center of Biomedical Research Excellence in stroke and a National Center of Neuromodulation for Rehabilitation. In addition, the Obesity Retreat also generated collaborative projects between pediatric researchers and community organizations, including a school-based study focused on pediatric obesity that translated into policy changes regarding daily dietary guidelines in two SC school districts. There were active research programs related to the mHealth and Tobacco Control Program ongoing at the Medical University of South Carolina before the respective two retreats were held. The retreats enhanced the subsequent research of the two programs resulting a number of new extramural grants and new faculty recruitment to the Tobacco Control Program.

The average cost per retreat was approximately \$5000. SCTR Pilot Project Program provided pilot project funding support of \$482,504 (as direct costs) for the 14 projects that emanated from the retreats (total \$ spent on the 10 retreats + 14 pilot projects = \$50,000 + \$482,504 = \$532,504). A conservative estimate of the total extramural grant funding received as result of the retreats, as mentioned above, was \$20,228,047 (direct and indirect costs) resulting a return on investment (ROI) of approximately \$38 for each dollar spent on the retreats and retreat emanated pilot projects. We recognize that this is only an estimate since not all the attendees responded to the follow-up surveys, but is reasonably close to what we feel is the ROI.

Analysis of bibliometric data from our research networking system (RNS) provides supporting evidence of increased team science among the SCTR Pilot Project Program funded investigators (Obeid *et al*, Science of Team Science Conference, 2015, figure 3). The RNS analysis was performed using randomly selected 44 unique PIs, who received SCTR Institute pilot project funds and had 140 publications that cited the SCTR Institute grant number, and a matching cohort of 44 individuals who were not funded by the SCTR Institute pilot project funds and had 145 miscellaneous publications that cited non-SCTR Institute funding (control group). Among the 44 PIs who received the SCTR Institute pilot project funds included 5 PIs from the 14 retreat generated pilot projects (table 2). The RNS analysis was performed from the projects funded during the period of 2010–2013 to assess the development of team science and translational impact over time. The RNS analysis showed that the pilot project funded investigators had significantly higher degree centrality with an average of 3.16 unique co-authors per individual when compared with that of 1.23 in the control group.

DISCUSSION

The retreat format has proven to be an effective approach to foster new interdisciplinary research team collaborations and innovative translational research projects. The SCTR Institute Pilot Project Program funding has provided support to promote the formation of multidisciplinary translational research teams by providing a venue, structure

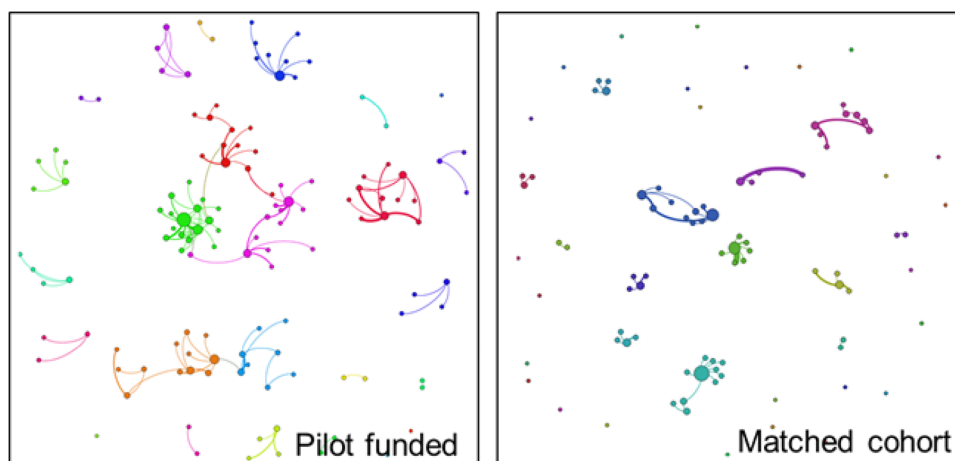


Figure 3 Network analysis performed on 44 South Carolina Clinical and Translational Research (SCTR) Institute pilot project program funded individuals with 140 publications that cited the SCTR Institute grant number and a randomly selected matching cohort (control group) of 44 individuals with 145 publications citing other non-SCTR Institute funding. The pilot project program funded individuals had significantly higher degree centrality with an average of 3.16 unique coauthors per individual versus 1.23 in the control group. Colors randomly represent different clusters.

and format that includes networking and pilot funding opportunities in key thematic areas. Attendees have uniformly recognized the retreats as the largest convener of engaged investigators and other stakeholders to focus on important health-related topics within South Carolina and nationally. There has been an evolution in the selection of retreat themes and formats that reflects a larger inclusiveness of community members and state-wide stakeholders. For example, the recent Tobacco Control retreat was generated by a partnership of the academic investigators in the tobacco-related disciplines and state-wide partners from American Lung Association, Department of Health and Environmental Control's Tobacco Prevention and Control, American Cancer Society Cancer Action Network and the South Carolina Tobacco-Free Collaborative.

Lessons learnt have improved the retreats over time. The Bioengineering retreat format was a 2-day event which included a poster reception on the evening before the scientific presentations as an additional networking opportunity. This event was not well attended and this format was dropped in subsequent retreats. We have enhanced the number and diversity of attendees and quality over time based on attendees evaluation form feedback and by reaching out to a broader audience within the state. In addition to the retreats and pilot funding support, we have also provided free science and biostatistics review critiques to all the pilot project applicants. Although we continue to anticipate more positive outcomes of the retreats, we face a challenge in gathering postretreat follow-up data from the attendees. We have sent REDCap surveys annually to collect retreat outcomes such as development of new research teams, successful extramural grant applications and publications that may have emanated from the retreats. The response rate to these surveys is only ~35%, so the results are likely skewed by those with more favorable views and outcomes being most likely to respond. Although the RNS analysis showed evidence of increased team science in the SCTR Institute pilot project funded PIs, the results are not limited to the retreat generated pilot

projects PIs. Further work needs to be performed with more comprehensive analysis of funded projects resulting from the retreats. However, our RNS results are in accordance with previous studies where an increasing trend in collaborations and team science efforts was found among the CTSA-affiliated investigators compared with pre-CTSA and post-CTSA funding.^{9 17} The RNS tools such as Harvard Profiles have been developed as valuable tools for evaluating changes in scientific collaborations over time. We have adopted Harvard Profiles open source software and used bibliometric data from it for the RNS analysis. Further, the RNS enables users to identify potential collaborators and discover research expertise across multiple disciplines.¹⁸

In summary, the retreat format appears to be effective in building new interdisciplinary research teams and collaborations to develop innovative research projects to advance the translational research.

CONCLUSION

The SCTR Institute Pilot Project Program has sponsored 10 Scientific Retreats to date, covering a broad range of topics critical to biomedical research and community needs. About 1000 attendees across the state representing different disciplines have attended. The retreat evaluation data revealed favorable feedback from the attendees for satisfaction with the retreat and achieving its objective as a stimulator of translational interdisciplinary team building. The SCTR Pilot Project Program sponsored scientific retreats have been a successful mechanism to stimulate novel teams and interdisciplinary research. Future retreats will continue to target topics of cross-cutting importance to biomedical and public health research.

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